

## Math 155 — Epidemiology

## Review Questions

## Problem 1

In 1970, the crude mortality rate (all causes) for Guyana (a developing country) was 6.8 per 1000 and for the United States it was 9.4 per 1000.

- (a) Can the lower crude mortality rate in Guyana be explained by the fact that the United States has a larger population? Explain your answer.
- (b) Give a probable explanation for the lower crude mortality rate in Guyana.

## Problem 2

Crude and age-adjusted mortality rates (per 100,000 people) from “arteriosclerotic and degenerative heart diseases” are shown for Chile and the United States for 1967.

Country	Crude Rates	Age-Adjusted Rates
Chile	67.4	58.2
United States	316.3	131.4
Ratio: US/Chile	4.7	2.3

Which of the two rates is preferable for comparing the mortality rate from heart disease in the two countries? Why? Why do the ratios of the crude and age-adjusted rates for the two countries differ?

## Problem 3

Assume that the prevalence of coronary heart disease decreases after age 70, but its incidence continues to increase with age. What is the most probable explanation for the divergence of these rates?

## Problem 4

Two thousand women aged 55 years were given a health check and 100 were found to have high blood pressure. Ten years later all 2000 women attended a second check and another 300 women had developed high blood pressure.

- (a) What was the prevalence of high blood pressure in the women (i) at age 55 and (ii) at age 65?
- (b) How many women were “at risk” of developing high blood pressure at the start of the 10-year period?
- (c) What was the incidence of high blood pressure in these women? Is this a measure of cumulative incidence or an incidence rate?
- Assume that, on average, each of the 300 women who developed high blood pressure did so half-way through the ten year follow-up period.
- (d) Calculate the total number of person-years at risk (of developing high blood pressure) during the 10 years.
- (e) What was the incidence rate of high blood pressure in these women?

### Problem 5

Four rats in one cage were found dead at a university animal colony. In the adjacent cage, one rat convulsed and died, two rats became ill but survived, and one rat was ill. The veterinarian declared that an epizootic was present (epizootic — epidemic in animals).

Which type of study was this:

- ☐ A Uncontrolled observation
- ☐ B Cross-sectional or prevalence study
- ☐ C Experiment
- ☐ D Cohort Study
- ☐ E Case-control study

### Problem 6

The study hypothesis is that alcoholics have an increased incidence of fatal automobile accidents. Design a case-control study to test this hypothesis using the following headings:

- (a) Diagnosis of cases — difficult or not? Where would you find cases?
- (b) Name a suitable population from which to choose controls.
- (c) List matching characteristics for controls.
- (d) What essential characteristic must you determine for each study member, and what difficulties might be encountered in determining this characteristic?

### Problem 7

The likelihood of a pathogen or agent being transmitted from one infected person to another susceptible person is referred to as which of the following?

invasiveness variability virulence communicability

### Problem 8

Which of the following terms refers to a persistent, expected level of disease in a defined population?

epidemic outbreak endemic pandemic

### Problem 9

Serial surveys involve which of the following?

- ☐ A Ecologic data
- ☐ B Cross-sectional data
- ☐ C Case-control data
- ☐ D Cohort data

### Problem 10

Match the following as a **descriptive** or an **analytic** epidemiological study.

- Who descriptive analytic
- Why descriptive analytic
- How descriptive analytic
- What descriptive analytic
- When descriptive analytic
- Where descriptive analytic

### Problem 11

The outbreak of an illness among football players and coaches is hypothesized to be associated with a person's location — the north versus the south wing — in an athletic training center. Each player and coach was asked where he was practicing, resulting in the following  $2 \times 2$  table.

Location	Illness	
	Yes	No
South	25	13
North	5	15

Use an appropriate measure to calculate the association between location and illness.

1.2 2.6 3.0 4.9 5.0

### Problem 12

Suppose you wanted to monitor the trend in age-adjusted incidence rates of breast cancer over the calendar years 1980 through 2000. Which of the following standard populations is the most appropriate for adjusting the rates throughout this period?

- ☐ A 1980
- ☐ B 1990
- ☐ C 2000
- ☐ D It does not matter.

### Problem 13

In Los Angeles, public health authorities identified 100 people with disease X. These cases came from 40 affected households with 230 people. Assuming that each household had only one primary case and that each primary case attended a local daycare center, what is the secondary attack rate?

- ☐ A 32%
- ☐ B 17%
- ☐ C 43%
- ☐ D 67%

### Problem 14

Answer these true-or-false questions.

1. Cancer screening is a form of primary prevention. True False
2. The ecologic study design is a useful approach for measuring the association between exposure and disease at the individual level. True False
3. Incidence is a better measure of disease risk than prevalence. True False
4. If the disease is common, the odds ratio will approximately equal the risk ratio. True False
5. In a case-control study, the ratio of cases to controls should always be 1:1. True False

### Problem 15

A screening test for a newly discovered disease is being evaluated. In order to determine the effectiveness of the new test, it was administered to 900 workers.

150 of the individuals diagnosed with the disease tested positive. A negative test finding occurred in 60 people who had the disease. A total of 50 persons not diseased tested positive for it.

- (a) Draw the appropriate  $2 \times 2$  table to represent the above information. Double check it to make sure that you have it right.

For each of the following, choose the best answer. You may also want to show your answer in terms of the numbers you entered in the table, for example in the form 60/150.

- (b) What is the prevalence of disease cases in the population?
- ☐ A 77%
  - ☐ B 75%
  - ☐ C 9%
  - ☐ D 23%
  - ☐ E Can't be determined from the information given.

- (c) What is the sensitivity of the test?

- ☐ A 71.4%
- ☐ B 74.0%
- ☐ C 92.8%
- ☐ D 23.3%

- (d) What is the specificity of the test?

- ☐ A 46.9%
- ☐ B 89.3%
- ☐ C 92.8%
- ☐ D 27.8%

- (e) What is the overall accuracy of the test?

- ☐ A 71%
- ☐ B 75%
- ☐ C 78%
- ☐ D 88%

- (f) What is the predictive value of a positive test? (Positive predictive value.)

- ☐ A 53.8%
- ☐ B 71.1%
- ☐ C 78.8%
- ☐ D 75.0%

- (g) What is the predictive value of a negative test? (Negative predictive value.)

- ☐ A 76.7%
- ☐ B 88.8%
- ☐ C 91.4%
- ☐ D 92.8%

- (h) Say whether "accuracy" is a good measure of the effectiveness of a diagnostic test. Explain why or why not.

### Problem 16

Describe the basic means of surveillance commonly used in public health. Explain how these support or fail to support surveillance of the outbreak of H1N1. [10 minutes]

### Problem 17

Write a short answer to each of the following. (You might want to cut-and-paste the list, so that you fill in your answer underneath the corresponding item.)

- (a) What is a confounder? What problems or opportunities does confounding produce? Describe some strategies for dealing with the problems or for exploiting the opportunities.
- (b) What is the difference between relative and absolute risk. Which is more informative in what situations?
- (c) Given an example of a setting in which it would be appropriate to calculate an odds ratio. (You can make up the example, but make it plausible.) Create a table in the standard format that gives an odds ratio of 3. You can make up the numbers any way you want.

- (d) Compare and contrast cohort and case-control studies? In what circumstances is a case-control study most appropriate?
- (e) What is an “epidemic curve?” Describe how the epidemic curves for a point source and a propagative epidemic differ?

### Problem 18

Which study design is best suited for establishing temporality?

- ☐ A Case-Control  
☐ B Cross-Sectional  
☐ C Prospective Cohort  
☐ D Retrospective Cohort

### Problem 19

Cohort studies are prone to bias because of selection. Explain how the healthy-worker effect is a type of selection bias.

### Problem 20

In a cohort study, a group of boys aged 8-15 years who were arrested because of substance abuse and identified as chemically dependent, were followed for 15 years. These boys were also classified according to whether they had a history of sexual abuse. Of interest was whether a history of sexual abuse was significantly associated with suicide attempt in these chemically dependent boys, the data for which are presented in the table:

History of Sexual Abuse	Suicide Attempt	
	Yes	No
Yes	11	34
No	29	224

- (a) What is the risk of suicide attempt for the chemically dependent boys with a history of sexual abuse?
- ☐ A  $11/45 = 244$  per thousand  
☐ B  $11/34 = 323$  per thousand  
☐ C  $29/253 = 115$  per thousand  
☐ D  $29/224 = 129$  per thousand  
☐ E  $30/258 = 116$  per thousand
- (b) What is the risk of suicide attempt for the chemically dependent boys without a history of sexual abuse?
- ☐ A  $11/45 = 244$  per thousand  
☐ B  $11/34 = 323$  per thousand  
☐ C  $29/253 = 115$  per thousand  
☐ D  $29/224 = 129$  per thousand  
☐ E  $30/258 = 116$  per thousand

- (c) What is the risk ratio?

- ☐ A  $323/129$   
☐ B  $244/115$   
☐ C  $115/129$   
☐ D  $11 \cdot 224/29 \cdot 34$

- (d) Suppose eight boys with a history of sexual abuse were lost to follow-up and therefore not reported in the table. In analyzing the situation, you estimate risk ratios for two extreme hypothetical scenarios, one in which all the missing boys attempted suicide, and the other in which none of the missing boys attempted suicide. You get two confidence intervals on the risk ratio:

- (i) 1.90 to 5.14  
(ii) 0.97 to 3.39.

Which hypothetical scenario does confidence interval (i) correspond to:

- ☐ A All the missing boys committed suicide.  
☐ B None of the missing boys committed suicide.  
☐ C No way to know.

### Problem 21

A cohort study involving Swedish females born between 1952 and 1989 assessed the association between eating disorders and parental education. From the results of this study presented in the table, calculate an appropriate measure to indicate whether a relationship exists between mother's education and the daughter's risk of having an eating disorder and present your conclusion.

Mother's Education	Number	Percent	Number of Events	Person-Years at Risk
Elementary	2791	21.3	10	42592
Secondary	6365	48.5	21	80468
Post-secondary	3968	30.2	22	43358

### Problem 22

A trial is likely to be underpowered, biased, or misleading if which of the following occurs:

- ☐ A A large number of participants is lost to follow up.  
☐ B A substantial number of participants do not adhere to the study intervention.  
☐ C Baseline variables are not balanced between intervention groups.  
☐ D All of the above lead to these problems.